

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1 (currently amended): A method of fabricating a silicon-on-insulator structure having a silicon ~~surface~~ layer in a semiconductor workpiece, said method comprising:

placing said workpiece in a processing zone of a chamber bounded by a chamber side wall and a chamber ceiling facing said workpiece and between a pair of ports of said chamber near generally opposite sides of said processing zone and connected together by an external conduit of said chamber;

maintaining said workpiece at an elevated temperature;
introducing into said chamber a process gas comprising oxygen;

generating from said process gas a plasma current and causing said plasma current to oscillate in a circulatory reentrant path comprising said conduit and said processing zone.

Claim 2 (currently amended): The method of Claim 1 further comprising:

applying a bias to said workpiece and setting said bias to a level corresponding to an implant depth in said workpiece below said silicon ~~surface~~ layer to which oxygen atoms are to be implanted, whereby to form an oxygen-implanted layer in said workpiece having an oxygen concentration distribution generally centered at said implant depth.

Claim 3 (original): The method of Claim 2 wherein the step

of applying a bias to said workpiece comprises applying a pulsed D.C. bias voltage to said workpiece.

Claim 4 (original): The method of Claim 1 wherein the step of generating a plasma current comprises coupling RF plasma source power into said conduit, whereby to cause said plasma current to oscillate at a frequency of said RF plasma source power.

Claim 5 (currently amended): The method of Claim 2 wherein said oxygen concentration distribution has a finite oxygen concentration in said silicon ~~surface~~ layer, said method further comprising:

reducing said oxygen concentration in said silicon ~~surface~~ layer.

Claim 6 (currently amended): The method of Claim 5 wherein the step of reducing said oxygen concentration in said silicon ~~surface~~ layer comprises:

enriching the silicon content of said silicon ~~surface~~ layer by implanting silicon atoms into said silicon ~~surface~~ layer and then heating said workpiece.

Claim 7 (currently amended): The method of Claim 5 wherein the step of reducing said oxygen concentration in said silicon ~~surface~~ layer comprises:

implanting an oxygen-getter species into said silicon ~~surface~~ layer and heating said workpiece.

Claim 8 (original): The method of Claim 7 wherein said oxygen-getter species comprises hydrogen.

Claim 9 (currently amended): The method of Claim 5 wherein the step of reducing said oxygen concentration in said silicon ~~surface~~ layer comprises:

ion implanting a damage layer at or near said implant depth of said oxygen-implanted layer;

heating said wafer so as to cause the implanted oxygen in at least said silicon ~~surface~~ layer to migrate away from said silicon ~~surface~~ layer.

Claim 10 (original): The method of Claim 9 wherein the step of ion implanting the deep damage layer is carried out by ion beam implantation of an atomic species to an implanted concentration less than that of said oxygen-implanted layer whereby to reduce the amount of time required to perform said ion beam implantation.

Claim 11 (original): The method of Claim 10 wherein said atomic species comprises at least one of silicon, oxygen, hydrogen.

Claim 12 (original): The method of Claim 10 wherein said implanted concentration of said deep damage layer is on the order of about 10^{15} cm⁻³.

Claim 13 (original): The method of Claim 9 wherein the step of ion implanting the deep damage layer is carried out by plasma immersion ion implantation.

Claim 14 (original): The method of Claim 13 wherein the step of plasma immersion ion implantation comprises:

placing said workpiece in a processing zone of a chamber bounded by a chamber side wall and a chamber ceiling facing said workpiece and between a pair of ports of said chamber near generally opposite sides of said processing zone and connected together by an external conduit of said chamber;

maintaining said workpiece at an elevated temperature;

introducing into said chamber a process gas comprising said atomic species;

generating from said process gas a plasma current and causing said plasma current to oscillate in a circulatory reentrant path comprising said conduit and said processing zone; and

applying a bias voltage on said workpiece corresponding to a deep implant depth below the implant depth of said oxygen-implanted layer.

Claim 15 (currently amended): The method of Claim 5 wherein the step of reducing said oxygen concentration in said silicon ~~surface~~ layer reduces said oxygen concentration below a threshold value under which epitaxial growth of a crystalline silicon layer on said silicon ~~surface~~ layer can be carried out.

Claim 16 (original): The method of Claim 15 wherein said threshold value is about 10^{18} cm⁻³.

Claim 17 (currently amended): The method of Claim 15 further comprising:
depositing an epitaxial silicon layer on said silicon ~~surface~~ layer.

Claim 18 (currently amended): The method of Claim 5 wherein the step of reducing said oxygen concentration in said silicon ~~surface~~ layer comprises:

enriching the silicon content of said silicon ~~surface~~ layer by implanting silicon atoms into said silicon ~~surface~~ layer;

implanting an oxygen-getter species into said silicon ~~surface~~ layer;

ion implanting a damage layer at or near said implant depth of the implanted oxygen;

heating said wafer to a sufficient temperature and for a sufficient time to cause the implanted silicon to become substitutional in said silicon ~~surface~~ layer, and implanted oxygen in or near said silicon ~~surface~~ layer to migrate away from said silicon ~~surface~~ layer.

Claim 19 (original): The method of Claim 18 wherein said oxygen-getter species comprises hydrogen.

Claim 20 (currently amended): The method of Claim 18 wherein the step of reducing said oxygen concentration in said

silicon ~~surface~~ layer reduces said oxygen concentration below a threshold value under which epitaxial growth of a crystalline silicon layer on said silicon ~~surface~~ layer can be carried out.

Claim 21 (original): The method of Claim 20 wherein said threshold value is about 10^{18} cm⁻³.

Claim 22 (currently amended): The method of Claim 5 wherein the step of reducing said oxygen concentration in said silicon ~~surface~~ layer comprises:

enriching the silicon content of said silicon ~~surface~~ layer by implanting silicon atoms into said silicon ~~surface~~ layer;

ion implanting a deep damage layer generally at said implant depth of the implanted oxygen;

heating said wafer so as to cause implanted oxygen in or near said silicon ~~surface~~ layer to migrate away from said silicon ~~surface~~ layer and the implanted silicon to become substitutional in said silicon ~~surface~~ layer.

Claim 23 (currently amended): The method of Claim 22 wherein the step of reducing said oxygen concentration in said silicon ~~surface~~ layer reduces said oxygen concentration below a threshold value under which epitaxial growth of a crystalline silicon layer on said silicon ~~surface~~ layer can be carried out.

Claim 24 (original): The method of Claim 23 wherein said threshold value is about 10^{18} cm⁻³.

Claim 25 (original): The method of Claim 1 wherein said process gas comprising oxygen comprises water vapor.

Claim 26 (currently amended): The method of Claim 1 further comprising:

immersing said workpiece in a plasma containing silicon ions while applying a bias voltage to said workpiece;
setting said bias voltage at a level such that silicon atoms are implanted in said silicon ~~surface~~ layer;
heating said workpiece.

Claim 27 (currently amended): The method of Claim 26 further comprising depositing an epitaxial layer of silicon on said silicon ~~surface~~ layer.

Claim 28 (original): The method of Claim 26 wherein the step of depositing an epitaxial layer of silicon is performed before the step of heating the workpiece.

Claim 29 (original): The method of Claim 26 wherein the step of depositing an epitaxial layer of silicon is performed after the step of heating the workpiece.

Claim 30 (currently amended): The method of Claim 27 wherein the step of depositing an epitaxial layer of silicon comprises setting said bias voltage to a level such that silicon atoms from said plasma accumulate on top of said silicon ~~surface~~

layer.

Claim 31 (currently amended): The method of Claim 27 wherein the step of depositing an epitaxial layer of silicon is performed contemporaneously with the step of implanting silicon in said silicon ~~surface~~ layer by setting said bias voltage to a level at which some silicon atoms from said plasma accumulate on top of said silicon ~~surface~~ layer while other silicon atoms from said plasma are implanted in said silicon ~~surface~~ layer.

Claim 32 (currently amended): The method of Claim 26 wherein said plasma further contains hydrogen ions, said method further comprising:

setting said bias voltage to a level at which hydrogen atoms are implanted in said silicon ~~surface~~ layer.

Claim 33 (original): The method of Claim 26 wherein the step of immersing said workpiece in a plasma containing silicon ions comprises:

placing said workpiece in a processing zone of a chamber bounded by a chamber side wall and a chamber ceiling facing said workpiece and between a pair of ports of said chamber near generally opposite sides of said processing zone and connected together by an external conduit of said chamber;

maintaining said workpiece at an elevated temperature;
introducing into said chamber a process gas comprising silicon;

generating from said process gas a plasma current and causing said plasma current to oscillate in a circulatory reentrant path comprising said conduit and said processing zone.

Claim 34 (currently amended): A method of fabricating a silicon-on-insulator structure having a silicon ~~surface~~ layer in a semiconductor workpiece, said method comprising:

- maintaining said workpiece at an elevated temperature;
- producing an oxygen-containing plasma in said chamber;
- applying a bias to said workpiece and setting said bias to a level corresponding to an implant depth in said workpiece below said silicon ~~surface~~ layer to which oxygen atoms are to be implanted, whereby to form an oxygen-implanted layer in said workpiece having an oxygen concentration distribution generally centered at said implant depth and having a finite oxygen concentration in said silicon ~~surface~~ layer;
- reducing said oxygen concentration in said silicon ~~surface~~ layer.

Claim 35 (original): The method of Claim 34 wherein the step of applying a bias to said workpiece comprises applying a pulsed D.C. bias voltage to said workpiece.

Claim 36 (currently amended): The method of Claim 34 wherein the step of reducing said oxygen concentration in said silicon ~~surface~~ layer comprises:

- enriching the silicon content of said silicon ~~surface~~ layer by implanting silicon atoms into said silicon ~~surface~~ layer and then heating said workpiece.

Claim 37 (currently amended): The method of Claim 34

wherein the step of reducing said oxygen concentration in said silicon ~~surface~~ layer comprises:

implanting an oxygen-getter species into said silicon ~~surface~~ layer and then heating said workpiece.

Claim 38 (original): The method of Claim 37 wherein said oxygen-getter species comprises hydrogen.

Claim 39 (currently amended): The method of Claim 34 wherein the step of reducing said oxygen concentration in said silicon ~~surface~~ layer comprises:

ion implanting a damage layer at or near said implant depth of the implanted oxygen;

heating said wafer so as to cause the implanted oxygen in at least said silicon ~~surface~~ layer to migrate away from said silicon ~~surface~~ layer.

Claim 40 (original): The method of Claim 39 wherein the step of ion implanting the deep damage layer is carried out by ion beam implantation of one of oxygen, silicon, or hydrogen atoms to a reduced concentration less than that of said oxygen-implanted layer.

Claim 41 (original): The method of Claim 40 wherein said reduced concentration is on the order of about 10^{18} cm⁻³.

Claim 42 (currently amended): The method of Claim 34 wherein the step of reducing said oxygen concentration in said

silicon ~~surface~~ layer reduces said oxygen concentration below a threshold value below which epitaxial growth of a crystalline silicon layer on said silicon ~~surface~~ layer can be carried out.

Claim 43 (original): The method of Claim 42 wherein said threshold value is about 10^{18} cm⁻³.

Claim 44 (currently amended): The method of Claim 42 further comprising:
depositing an epitaxial silicon layer on said silicon ~~surface~~ layer.

Claim 45 (currently amended): The method of Claim 34 wherein the step of reducing said oxygen concentration in said silicon ~~surface~~ layer comprises:
enriching the silicon content of said silicon ~~surface~~ layer by implanting silicon atoms into said silicon ~~surface~~ layer;
implanting an oxygen-getter species into said silicon ~~surface~~ layer;
ion implanting a damage layer at or near said implant depth of the implanted oxygen;
heating said wafer so as to cause implanted oxygen in or near said silicon ~~surface~~ layer to migrate away from said silicon ~~surface~~ layer , and the implanted silicon to become substitutional in said silicon ~~surface~~ layer .

Claim 46 (original): The method of Claim 45 wherein said oxygen-getter species comprises hydrogen.

Claim 47 (currently amended): The method of Claim 45 wherein the step of reducing said oxygen concentration in said silicon ~~surface~~ layer reduces said oxygen concentration below a threshold value below which epitaxial growth of a crystalline silicon layer on said silicon ~~surface~~ layer can be carried out.

Claim 48 (original): The method of Claim 47 wherein said threshold value is about 10^{18} cm⁻³.

Claim 49 (currently amended): The method of Claim 34 wherein the step of reducing said oxygen concentration in said silicon ~~surface~~ layer comprises:

enriching the silicon content of said silicon ~~surface~~ layer by implanting silicon atoms into said silicon ~~surface~~ layer;

ion implanting a damage layer at or near said implant depth of the implanted oxygen;

heating said wafer so as to cause implanted oxygen in or near said silicon ~~surface~~ layer to migrate away from said silicon ~~surface~~ layer and the implanted silicon to become substitutional in said silicon ~~surface~~ layer.

Claim 50 (currently amended): The method of Claim 49 wherein the step of reducing said oxygen concentration in said silicon ~~surface~~ layer reduces said oxygen concentration below a threshold value below which epitaxial growth of a crystalline silicon layer on said silicon ~~surface~~ layer can be carried out.

Claim 51 (original): The method of Claim 50 wherein said threshold value is about 10^{18}cm^{-3} .

Claim 52 (currently amended): The method of Claim 34 further comprising:
immersing said workpiece in a plasma containing silicon ions while applying a bias voltage to said workpiece;
setting said bias voltage at a level such that silicon atoms are implanted in said silicon ~~surface~~ layer;
heating said workpiece.

Claim 53 (currently amended): The method of Claim 52 further comprising depositing an epitaxial layer of silicon on said silicon ~~surface~~ layer.

Claim 54 (original): The method of Claim 53 wherein the step of depositing an epitaxial layer of silicon is performed before the step of heating the workpiece.

Claim 55 (original): The method of Claim 53 wherein the step of depositing an epitaxial layer of silicon is performed after the step of heating the workpiece.

Claim 56 (currently amended): The method of Claim 53 wherein the step of depositing an epitaxial layer of silicon comprises setting said bias voltage to a level such that silicon atoms from said plasma accumulate on top of said silicon ~~surface~~

layer.

Claim 57 (currently amended): The method of Claim 53 wherein the step of depositing an epitaxial layer of silicon is carried out contemporaneously with the step of implanting silicon into said silicon ~~surface~~ layer, wherein said bias voltage is set to a level at which some silicon atoms from said plasma accumulate on top of said silicon ~~surface~~ layer while others of said silicon atoms are implanted in said silicon ~~surface~~ layer.

Claim 58 (original): The method of Claim 52 wherein the step of immersing said workpiece in a plasma containing silicon and hydrogen comprises generating a plasma from a silane process gas in said reactor and causing said process gas to oscillate in said circulatory reentrant path.

Claim 59 (currently amended): The method of Claim 52 wherein said plasma further contains hydrogen, said method further comprising setting said bias voltage to a level at which hydrogen atoms from said plasma are implanted in said silicon ~~surface~~ layer.